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The Limping Child

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THE LIMPING CHILD

Bob Wiley, PGY-2

April 1, 2021

DISCLOSURES

- None


Limping child
Traumatic
Atraumatic

LEARNING OBJECTIVES

- Review the definition of limp
- Describe the approach to initial evaluation of a limping child, including key items in the history and physical exam
- Appreciate the broad differential that one must keep when evaluating a limping child
- Understand the different types of limp and how they can be used to formulate a differential
- Recognize red flag signs and symptoms which require more urgent evaluation
- Use cases to demonstrate some of the common presentations that are seen by the GP

WHAT WE WILL NOT COVER

- Fractures or other traumatic causes of limp
- Every possible etiology of atraumatic limp
- In-depth discussion of treatment plans
- Normal gait biomechanics
- Gait assessment

LIMP DEFINITIONS

- An abnormality in gait that is caused by pain, weakness, or deformity
- Any deviation from normal age-appropriate gait pattern

The Bone & Joint Journal
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The limping child: epidemiology, assessment and outcome

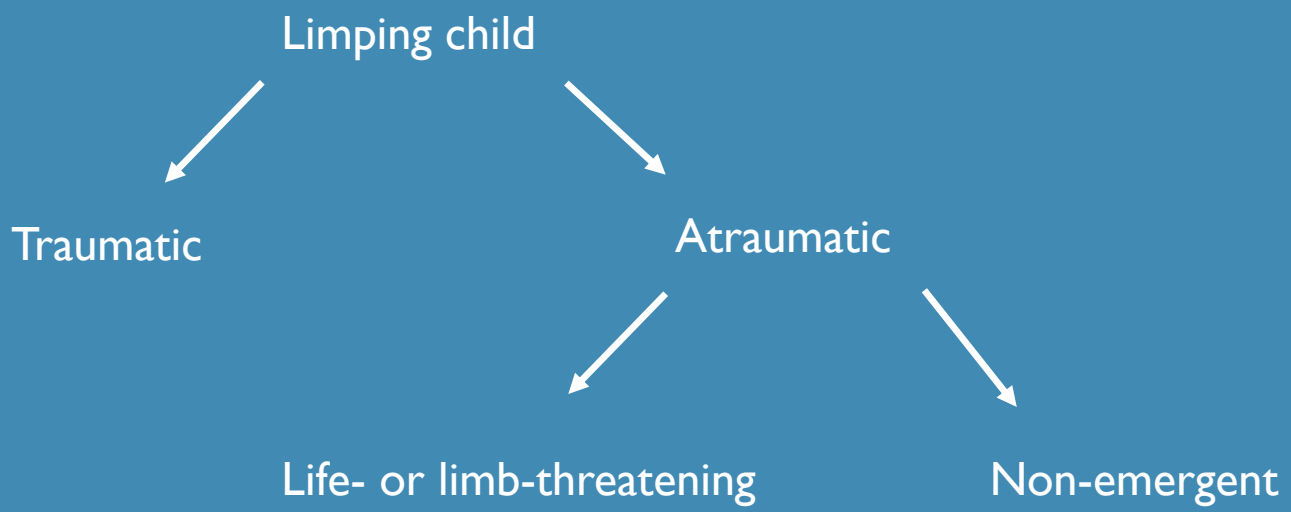
S. U. Fischer, T. F. Beattie

Published Online: 1 Nov 1999 | https://doi.org/10.1302/0301-620X.81B6.0811029

We investigated the epidemiology, assessment and outcome of acute atraumatic limp in 243 children under the age of 14 years presenting to a paediatric accident and emergency department (AED) over a period of six months. Data were collected at presentation and medical notes were re-examined after 18 to 21 months.

The incidence of limp was 1.8 per thousand. The male:female ratio was 1.7:1 and the median age 4.35 years. Limp was mainly right-sided (54%) and painful (80%); 33.7% of the children had localised pain in the hip. A preceding illness was found in 40%. The main diagnosis was 'irritable hip'/transient synovitis (39.5%); Perthes' disease accounted for 2%. Most patients (77%) were managed entirely in the AED.

Acute atraumatic limp is a common problem in children presenting to the AED. Most can be safely managed there if guidelines are followed and will have a benign outcome. Further studies are needed to identify the role of preceding illness in the aetiology of acute atraumatic limp.


Limping child
Traumatic
Atraumatic
Life- or limb-threatening
Non-emergent

RED FLAGS

- Fever
- Severe pain
- Severely limited ROM
- Refusal to bear weight
- Focal bony tenderness
- Recurrent nighttime pain

Life-threatening and common causes of limp in children

Life-threatening and other emergency conditions
▪ Bacterial (septic) arthritis
▪ Compartment syndrome
▪ Developmental dysplasia of the hip
▪ Infections with referred pain to the lower extremities*
▪ Malignancy¶
▪ Occult fracture (child abuse)
▪ Osteomyelitis
▪ Pyomyositis
▪ Slipped capital femoral epiphysis
▪ Spontaneous hemarthrosis (hemophilia)
▪ Testicular torsion
▪ Vasoocclusive crisis (sickle cell disease)
Common conditions
▪ Acute myositis (benign myositis of childhood)
▪ Infection such as cellulitis, cutaneous abscess, or perirectal abscess
▪ Fracture
▪ Lyme arthritis (endemic regions)
▪ Osteochondrosis[Δ]
▪ Plantar wart
▪ Soft tissue injury[◇]
▪ Traction apophysitis[§]
▪ Transient synovitis
Other conditions
▪ Idiopathic avascular necrosis of the hip (Legg-Calvé-Perthes disease)
▪ Joint hypermobility syndrome
▪ Neuromuscular disease[¥]
▪ Nonmalignant tumors
▪ Oligoarticular juvenile idiopathic arthritics and other rheumatic diseases
▪ Osteochondritis dissecans
▪ Other bone conditions[‡]
▪ Other inflammatory arthritis[†]
▪ Somatic syndrome disorder (conversion disorder)
▪ Spinal column conditions**
▪ Stress fractures

IT ALL STARTS WITH A GOOD HISTORY

- Age
- Acuity
- Recent trauma history
- Describe the limp
- Presence of pain
  - PQRST
- Chronic medical conditions
- FHx
- Baseline level of activity
  - Participation in sports
- Presence of other symptoms:
  - Constitutional symptoms (ie: Fever, night sweats)
  - Rash
- Recent illnesses
- Current medications
  - Abx? Immunosuppressants?

The location of pain does not necessarily reflect the location of pathology.

PHYSICAL EXAM

- Vitals, BMI
- General appearance
- Resting Limb position
- Palpate both legs
  - focal tenderness
  - masses
- Hips, Knees, Ankles
- Feet
- Spine, Back
- Nervous system → gait exam
- Abdomen, Pelvis
- GU
- Skin → areas of erythema, swelling, or deformity

PHYSICAL EXAM PEARLS

- Have parent/caregiver take them for a walk
  - Refusing to walk or stand → don't force it
- Examine area of pain last
- Inspect the child's shoes
- Examine both sides every time

TYPES OF LIMP

- Antalgic (most common)
- Trendelenburg
- Toe-walking
- Steppage
- Stooping
- Vaulting

Trendelenburg gait in a boy with slipped capital femoral epiphysis (SCFE)

(A) When stepping on the unaffected side, the pelvis remains level.
(B) When stepping on the affected side, the pelvis tilts downward toward the unaffected side, and there is a subtle shift of the torso.

Courtesy of William Phillips, MD.

Causes of limp by gait abnormality in children

Type of limp	Characteristics	Possible etiology
Antalgic gait	Most common; short-stance phase caused by pain in the weight-bearing extremity	Fracture (including toddler or Salter I fracture), unilateral slipped capital femoral epiphysis, apophysitis, soft tissue injury, transient synovitis, osteomyelitis, septic or other arthritis, foot foreign body, osteochondritis dissecans, hemarthrosis, vasoocclusive crisis, benign or malignant tumor, painful foot lesions (eg, plantar wart, hand-foot-mouth disease, or immunoglobulin A vasculitis [Henoch-Schönlein purpura])
Trendelenburg gait	Downward pelvic tilt during the swing phase caused by weakness or spasm in the contralateral gluteus medius muscle	Legg-Calvé-Perthes, unilateral slipped capital femoral epiphysis (moderate to severe chronic slip), or developmental dysplasia of the hip
Steppage gait	Seen with a foot drop; presents with exaggerated hip and knee flexion during the swing phase to clear the dropped foot from the floor	Neurologic diseases which cause loss of dorsiflexion of the ankle
Toe-walking gait	Child walks on his/her toes caused by heel pain or by increased flexor muscle tone in the lower leg	Mild cerebral palsy, Sever disease, heel foreign body, idiopathic, tethered spinal cord
Vaulting gait	The knee is hyperextended and locked at the end of the stance phase of the gait and the child vaults over the extremity	Limb length discrepancy or abnormal knee mobility
Stooping gait	Patient shuffles with hip flexed due to irritation of the psoas muscle by intraabdominal inflammation	Appendicitis, pelvic inflammatory disease, psoas muscle abscess

For a description of the normal pediatric gait cycle, refer to UpToDate topics on limp in children.

Causes of limp in children by location of abnormality

Lower extremity (bone)
Osteomyelitis
Fracture, including occult fracture (child abuse) and stress fracture
Traction apophysitis
Sinding-Larsen-Johansson disease (inferior patella)
Sever disease (calcaneus)
Osgood-Schlatter disease (tibial tuberosity)
Iselin disease (base of the 5th metatarsal)
Osteochondrosis
Freiberg disease (head of the 2nd metatarsal)
Köhler disease (navicular bone of the foot)
Slipped capital femoral epiphysis
Idiopathic avascular necrosis of the hip (Legg-Calvé-Perthes disease)
Benign and malignant tumors
Leukemia
Metastatic neuroblastoma
Osteogenic sarcoma
Ewing sarcoma
Osteoid osteoma
Limb length discrepancy
Pathologic varus (bow legs)
Pathologic valgus (knock knees)
Tarsal coalition
Torsional deformities
Vaso-occlusive crisis (sickle cell disease)
Lower extremity (joint)
Transient synovitis of the hip
Bacterial (septic) arthritis
Lyme arthritis (endemic regions)
Osteochondritis dissecans
Developmental dysplasia of the hip
Oligoarticular juvenile idiopathic arthritis (JIA) and other rheumatic diseases (eg, systemic lupus erythematosus, systemic JIA)
Immunoglobulin A vasculitis (Henoch-Schönlein purpura)
Serum sickness and serum sickness-like reactions
Reactive arthritis
Acute rheumatic fever
Joint hypermobility syndrome
Hemarthrosis (causes include trauma, hemophilia, and, rarely, pigmented villonodular synovitis)

Lower extremity (soft tissue)
Contusion (superficial or deep [muscle])
Muscle strain
Ligament sprain
Tendinopathy
Compartment syndrome
Benign acute myositis
Foot injury (foreign body, blisters, puncture wound, abrasions, or lacerations)
Hand, foot, and mouth disease (painful vesicles on the plantar foot)
Intramuscular vaccination
Insect bite or sting (eg, fire ant, bee, wasp, or yellow jacket)
Superficial infection (eg, cellulitis, cutaneous abscess, or perirectal abscess)
Pyomyositis
Spinal column
Spondylolysis and spondylolisthesis
Closed spinal dysraphism with tethered cord
Herniated vertebral disc
Spinal epidural abscess
Discitis
Skeletal tuberculosis (Pott disease)
Neuromuscular
Cerebral palsy
Peripheral neuropathy
Muscular dystrophy
Myasthenia gravis
Tick paralysis
Complex regional pain syndrome (reflex sympathetic dystrophy)
Spinal cord tumor
Intra-abdominal
Appendicitis
Pelvic inflammatory disease
Pelvic abscess
Psoas abscess
Iliac adenitis
Other
Testicular torsion
Somatic symptom disorder (conversion disorder)

CASES

CASE #1

KC is a 3 yo Caucasian F with no significant PMH presenting with 2 days of progressively worsening limp. Parents deny history of recent trauma. She has been hesitant to walk for the past 2 days and is now almost entirely refusing to put weight on her left leg. Last night she spiked a temperature of 101.9F which improved somewhat after Tylenol. This morning she barely touched her breakfast. Her mother is concerned that she looks "miserable" and is becoming increasingly irritable. She has had no known sick contacts.

CASE #1

Vitals:

T 101.5F

HR 140

BP 101/54

RR 22

SpO2 > 97% on RA

Heart Rate (beats/min)			Respiratory Rate (breaths/min)	
Age	**Awake**	**Asleep**	**Age**	**Normal**
Neonate (<28 d)	100-205	90-160	Infant (<1 y)	30-53
Infant (1-12 mos)	100-190			
Toddler (1-2 y)	98-140	80-120	Toddler (1-2 y)	22-37
Preschool (3-5 y)	80-120	65-100	Preschool (3-5 y)	20-28
School-age (6-11 y)	75-118	58-90	School-age (6-11 y)	18-25
Adolescent (12-15 y)	60-100	50-90	Adolescent (12-15 y)	12-20
Reference: PALS Guidelines, 2015				

Blood Pressure (mmHg)				
Age		**Systolic**	**Diastolic**	**Systolic Hypotension**
Birth (12 h)	<1 kg	39-59	16-36	<40-50
	3 kg	60-76	31-45	<50
Neonate (96 h)		67-84	35-53	<60
Infant (1-12 mos)		72-104	37-56	<70
Toddler (1-2 y)		86-106	42-63	<70 + (age in years × 2)
Preschool (3-5 y)		89-112	46-72	
School-age (6-9 y)		97-115	57-76	
Preadolescent (10-11 y)		102-120	61-80	<90
Adolescent (12-15 y)		110-131	64-83	

CASE #1

Physical Exam

General: Uncomfortable, in moderate distress. Ill-appearing

HEENT: No rhinorrhea. TMs wnl. Pharynx clear, no tonsillar enlargement

CV: Tachy. Warm and well-perfused

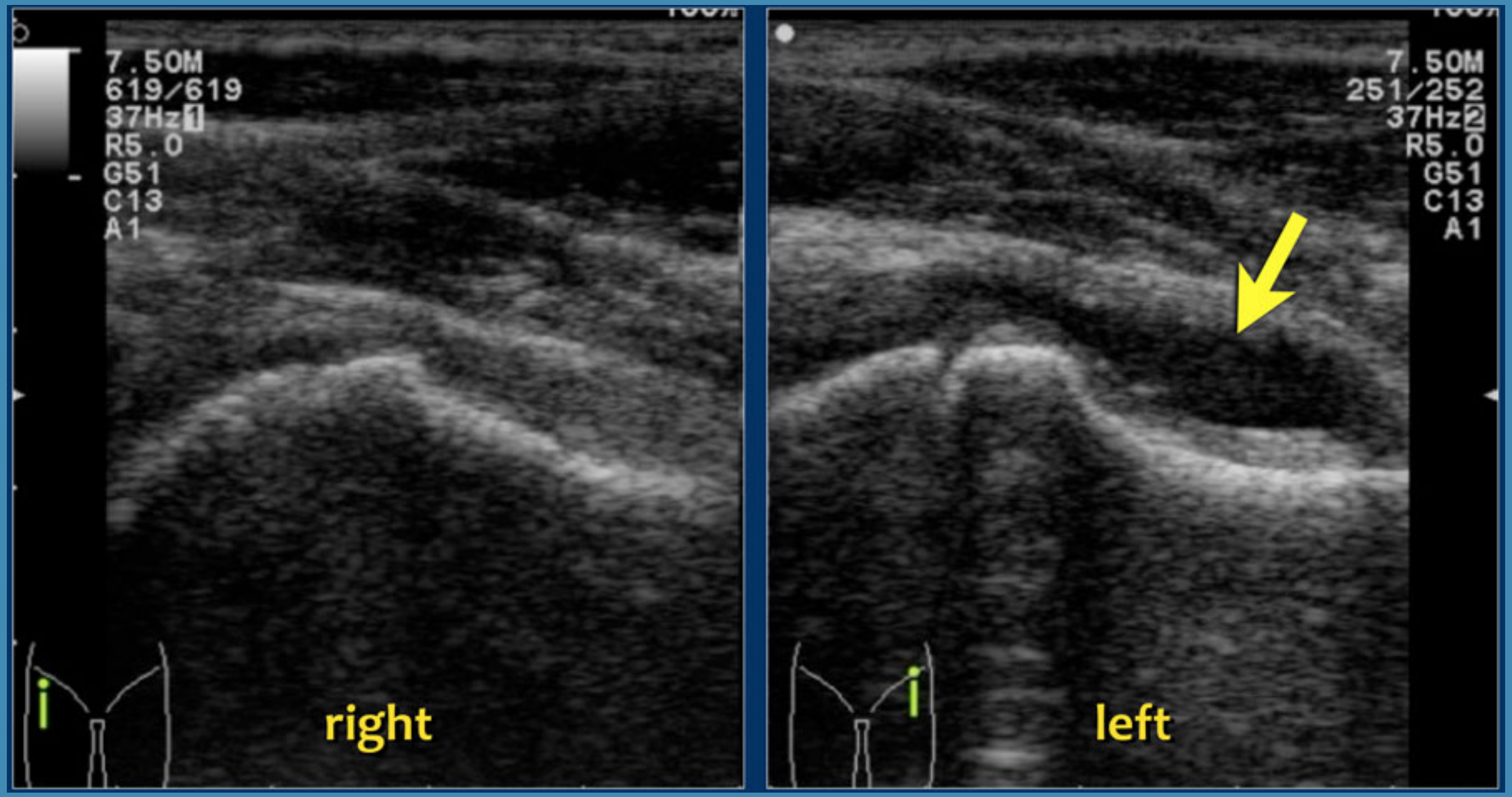
Pulm, Abd, Skin exams wnl

WORKUP?

LABS

WBC 19.2, 82% neutrophils
Hgb 13.6
ESR 57 (Ref: 0-13)
CRP 13 (Ref: 0-0.9)

IMAGING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619/619
37Hz1
R5.0
G51
C13
A1
right
7.50M
251/252
37Hz2
R5.0
G51
C13
A1
left

WHAT IS THE MOST LIKELY CAUSE OF LIMP IN THIS PATIENT?

SEPTIC ARTHRITIS

KC is a 3 yo Caucasian F with no significant PMH presenting with 2 days of progressively worsening limp. Parents deny history of recent trauma. She has been hesitant to walk for the past 2 days and is now almost entirely refusing to put weight on her left leg. Last night she spiked a temperature of 101.9F which improved somewhat after Tylenol. This morning she barely touched her breakfast. Her mother is concerned that she looks "miserable" and is becoming increasingly irritable. She has had no known sick contacts.

SEPTIC ARTHRITIS

- Pathologic invasion of the joint space with subsequent inflammation
- Most often from hematogenous spread
- 90% of cases are monoarticular
- Hips and knees most common

SEPTIC ARTHRITIS

- 1 in 100,000 in developed countries
- Average age 3-6 yo
- M > F (2:1)
- Risk factors:
  - Trauma
  - Immunocompromised

SEPTIC ARTHRITIS

- Medical emergency
- Acute onset (< 48 hrs)
- Exquisite joint pain, severely limited ROM, refusal to bear weight
- Fever, malaise, poor appetite, irritability
- Hip kept flexed, abducted, and externally rotated

- Urgent Ortho c/s for synovial fluid aspiration
  - Gram staining, culture, glucose, and cell count

CASE #2

CT is a 6 yo M with no significant PMH presenting with a limp x 1 day. Yesterday evening the patient began complaining of mild L anterior thigh pain. This morning, the pain worsened and patient had difficulty climbing steps. During the afternoon, he would not bear weight on the LLE. Temp at home 100.1F. Presented to PCP who referred patient to ED for further evaluation.

Patient has been in his usual state of health. Mother denies any recent illnesses. Slightly decreased appetite. Mother notes patient had a fall on the playground 2 weeks ago but otherwise denies trauma.

CASE #2

Vitals:

T 98.7F

HR 96

BP 85/59

RR 26

Spo2 100% on RA

Heart Rate (beats/min)		
Age	**Awake**	**Asleep**
Neonate (<28 d)	100-205	90-160
Infant (1-12 mos)	100-190	
Toddler (1-2 y)	98-140	80-120
Preschool (3-5 y)	80-120	65-100
School-age (6-11 y)	75-118	58-90
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Respiratory Rate (breaths/min)	
Age	**Normal**
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Toddler (1-2 y)	22-37
Preschool (3-5 y)	20-28
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Reference: PALS Guidelines, 2015

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Preadolescent (10-11 y)		102-120	61-80	<90
Adolescent (12-15 y)		110-131	64-83	

CASE #2

Physical exam:

Gen: NAD, comfortable lying in bed. Overall well-appearing

CV, Pulm, Abd, Back exams all normal.

MSK: Pain elicited in anterior thigh upon L hip flexion. L hip ROM limited by pain, resistant to passive movements. Pain worst with internal rotation. FABER negative. L knee mildly swollen with bruising over the patella. No knee swelling or tenderness, full ROM without pain. R hip and knee with full ROM, no pain.

Gait: Walking on L toes, barely putting weight on LLE

WORKUP?

LABS

WBC 8.8, PMNs 64.7%

Hgb 13.4

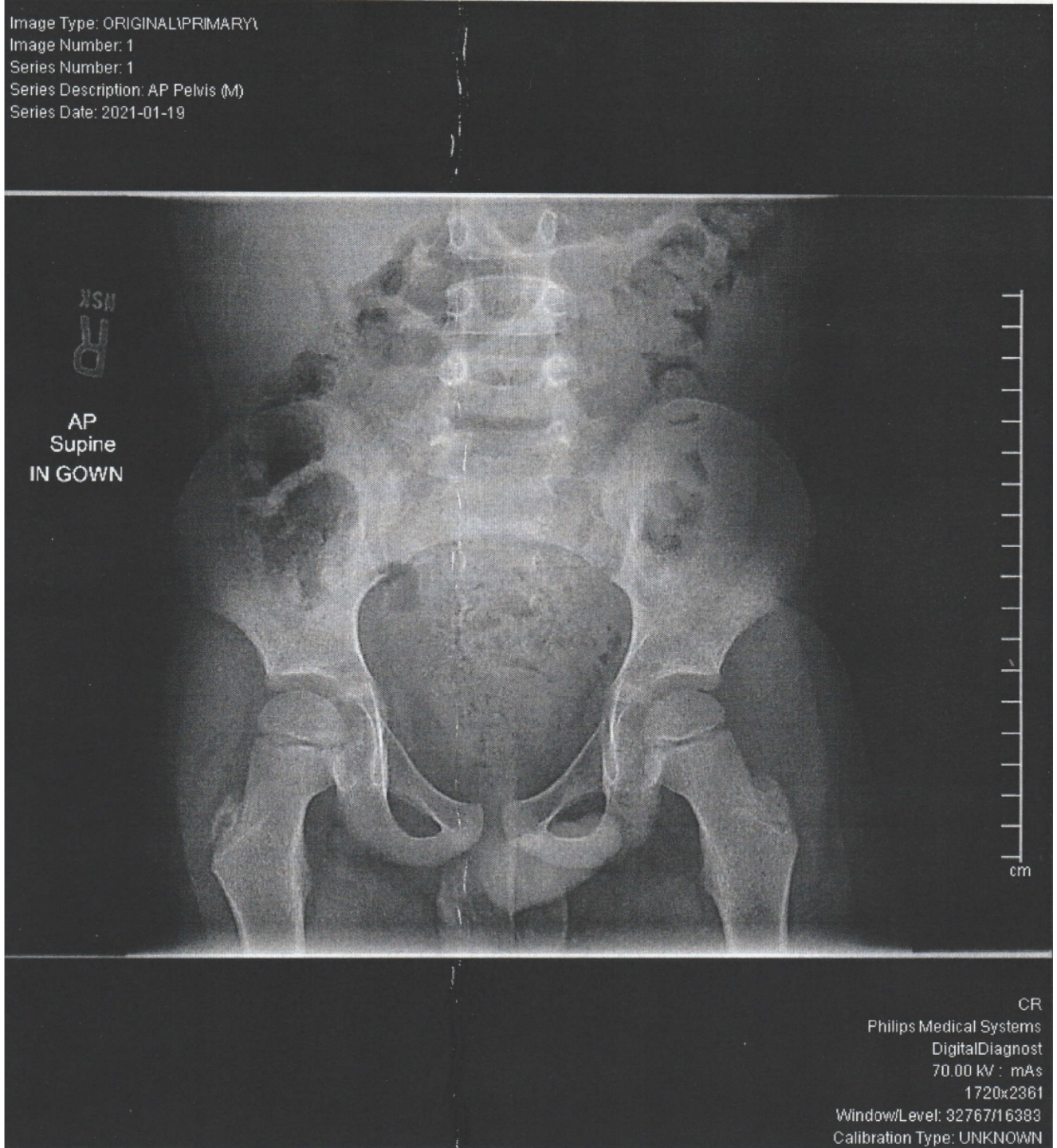
CRP 1.3 (Ref: 0-0.9)

ESR 6 (Ref: 0-13)

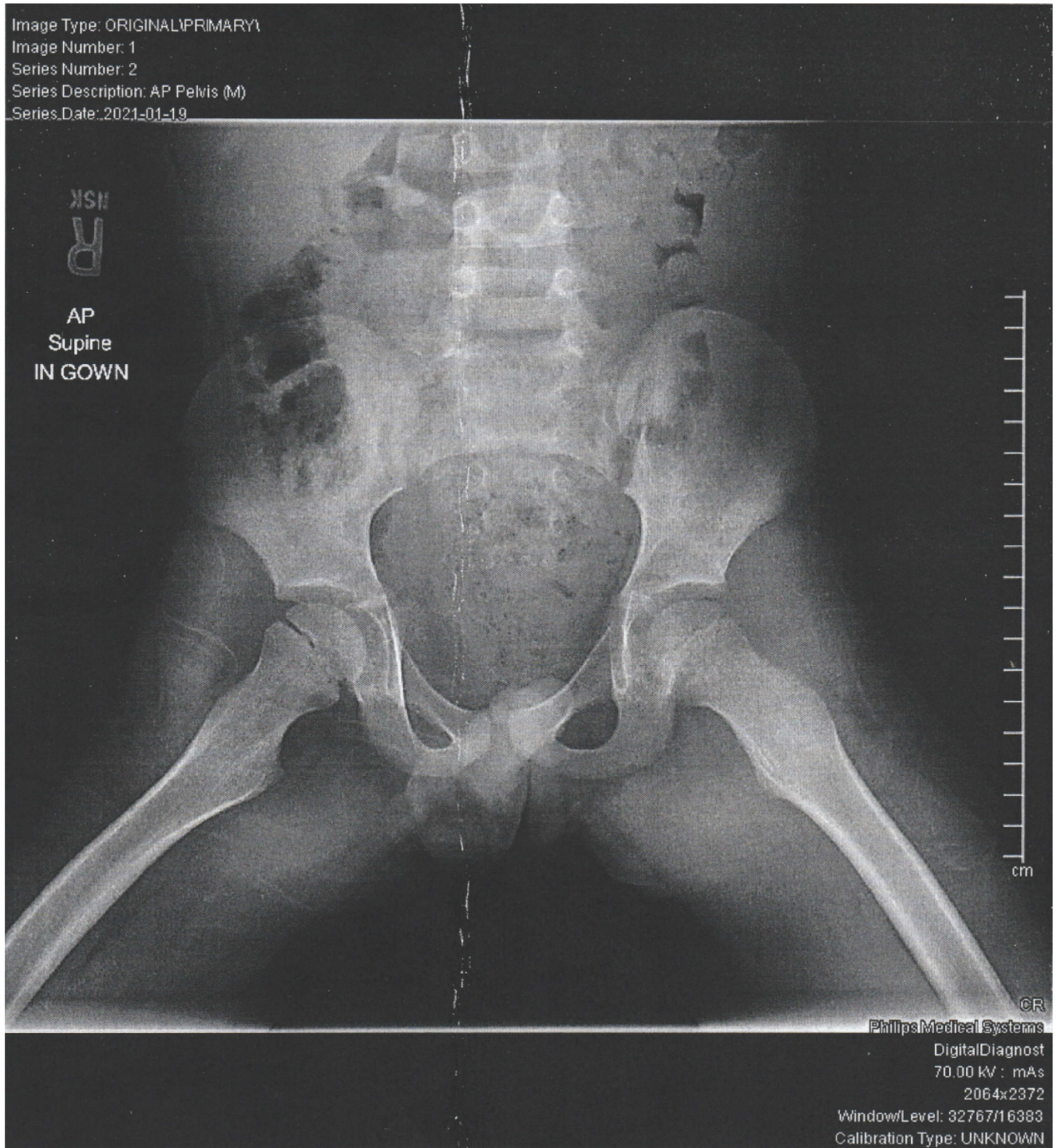
Lyme negative

IMAGING

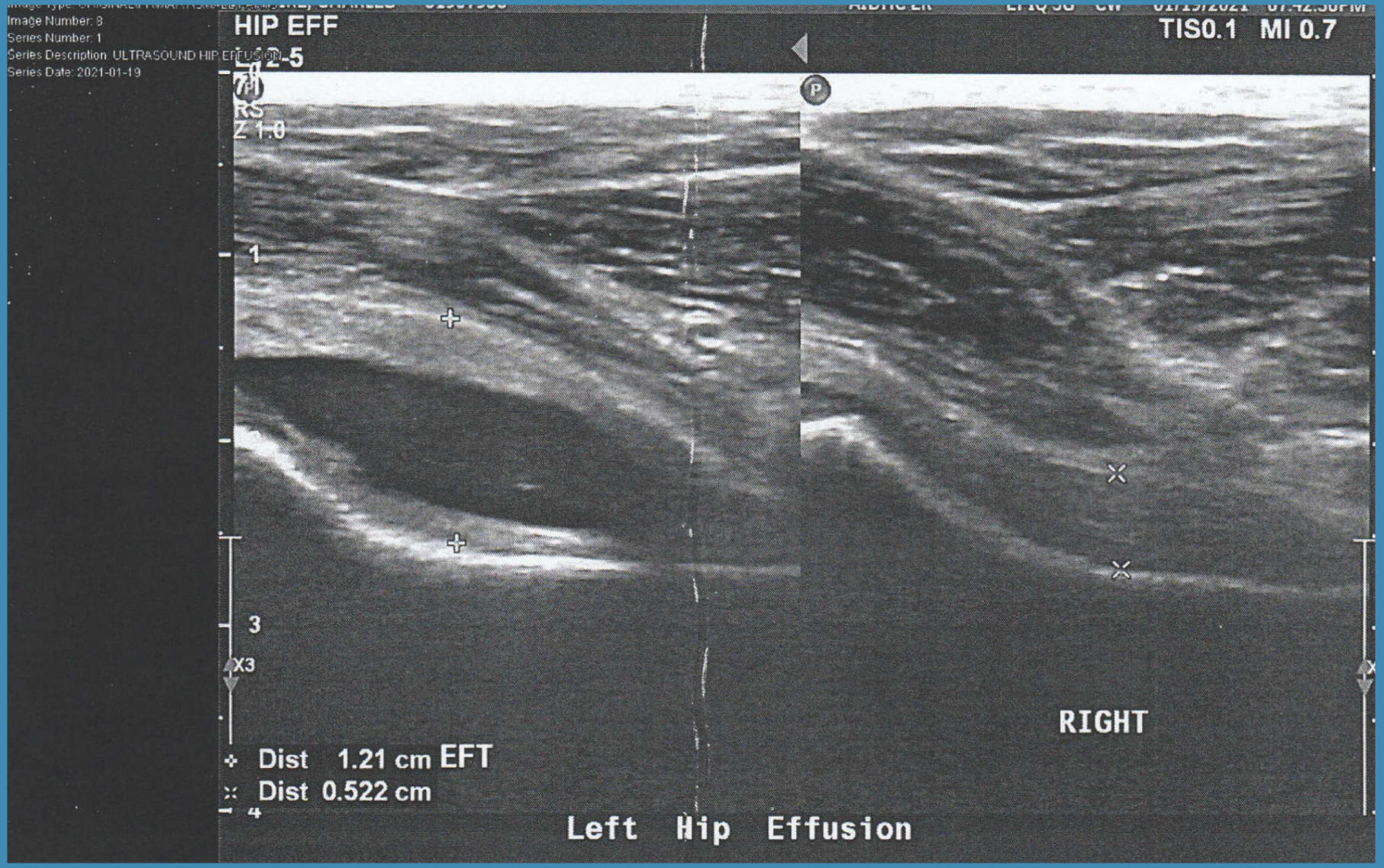
XRAY HIP/PELVIS



XRAY HIP/PELVIS



HIP ULTRASOUND



WHAT IS THE MOST LIKELY CAUSE OF THIS PATIENT'S LIMP?

TRANSIENT SYNOVITIS

CT is a 6 yo M with no significant PMH presenting with a limp x 1 day. Yesterday evening the patient began complaining of mild L anterior thigh pain. This morning, the pain worsened and patient had difficulty climbing steps. During the afternoon, he would not bear weight on the LLE. Temp at home 100.1F. Presented to PCP who referred patient to ED for further evaluation.

Patient has been in his usual state of health. Mother denies any recent illnesses. Some decreased appetite. Mother notes patient had a fall on the playground 2 weeks ago but otherwise denies trauma.

TRANSIENT SYNOVITIS

- Acute hip pain due to synovial inflammation and joint effusion
- Often unknown etiology, however preceding viral illness common
- Benign, self-limited

TRANSIENT SYNOVITIS

- 3-8 yo
- M > F (2:1)
- 3% of pediatric population
- Risk factors:
  - Recent viral URI
  - Recent GI, GU infections

TRANSIENT SYNOVITIS

- Acute onset (< 48 hrs)
- Afebrile, non-toxic appearing
- Mostly unilateral
- Uncomfortable but able to bear some weight
- Some ROM

- Antalgic gait
- Hip flexed, abducted, and externally rotated
- Internal rotation of hip particularly painful

KOCHER CRITERIA

Kocher Criteria	No (0 points)	Yes (1 point)
Non-Weight Bearing	☐	☐
Temp > 38.5° C (101.3° F)	☐	☐
ESR > 40 mm/hr	☐	☐
WBC >12,000 cells/mm^3	☐	☐

Points	Likelihood of Septic Arthritis
0	0.20%
1	3%
2	40%
3	93%
4	99%

TRANSIENT SYNOVITIS

- Conservative management
- Resolution within 1-2 weeks

- For our patient:
  - Kocher score = 0
  - Pain and limp improved after Toradol
  - Discharged home w/ outpatient follow up

CASE #3

ML is a 12 yo Hispanic M with no significant PMH presenting with worsening limp for the past 6 months. He has also noted stable L knee pain during this time. The knee pain is worsened by activity, although he was able to play soccer with his friends yesterday. He cannot recall a specific event that started the pain. No known trauma. He has otherwise been in his usual state of health with no recent illnesses.

CASE #3

Vitals:

AVSS

BMI 33

Physical Exam:

Gen: Well-appearing. Obese

Abd, back, neuro exams normal.

MSK: L knee without obvious swelling. No erythema or joint line tenderness, although there is reproducible tenderness at the proximal tibia. Hip, knee, and ankle with full ROM. Pain elicited with resisted knee extension. No joint laxity.

Gait: Mildly antalgic but intermittently normal

WORKUP?

LABS

IMAGING


L

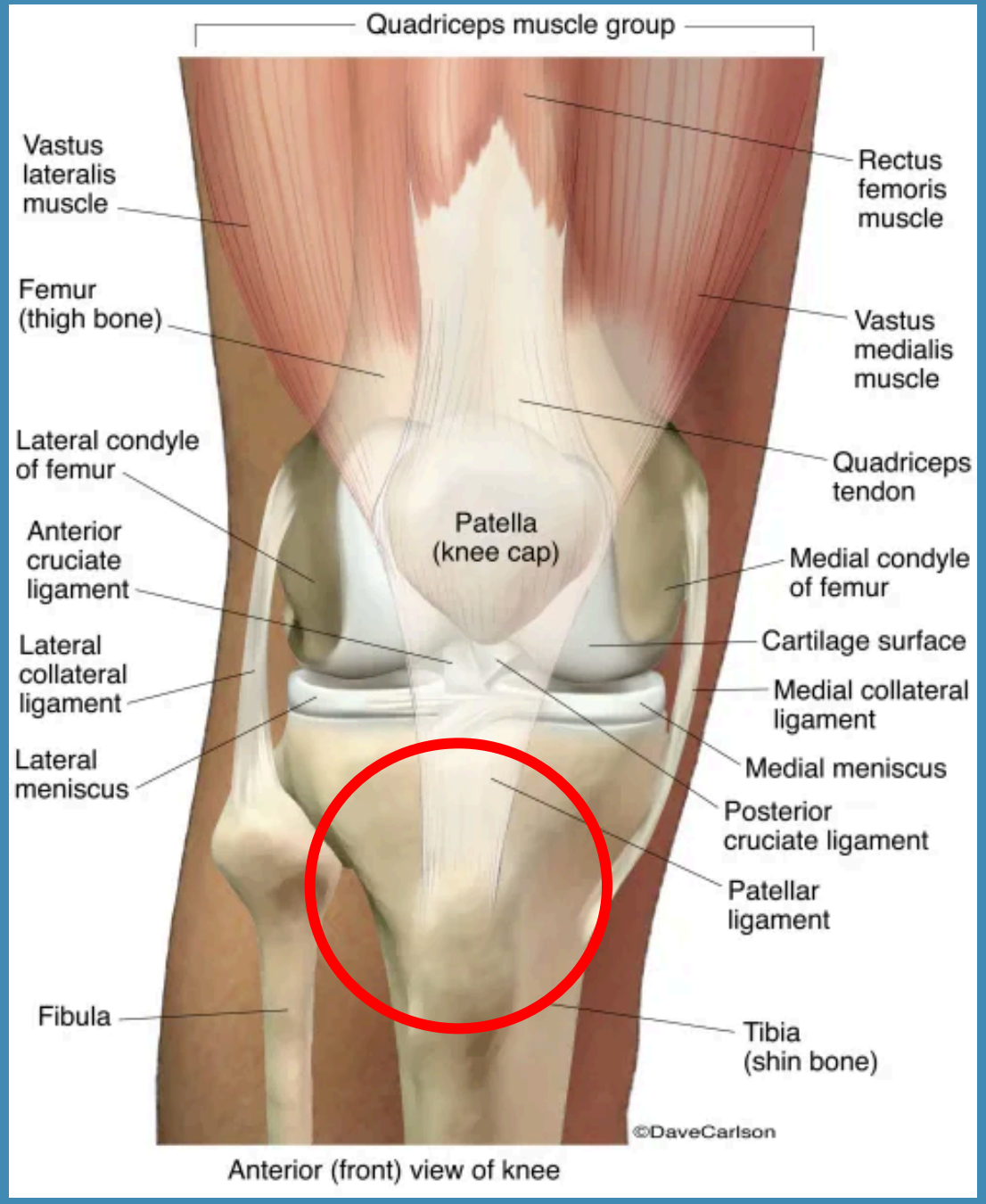
WHAT IS THE MOST LIKELY CAUSE OF THIS PATIENT'S LIMP?

OSGOOD-SCHLATTER DISEASE

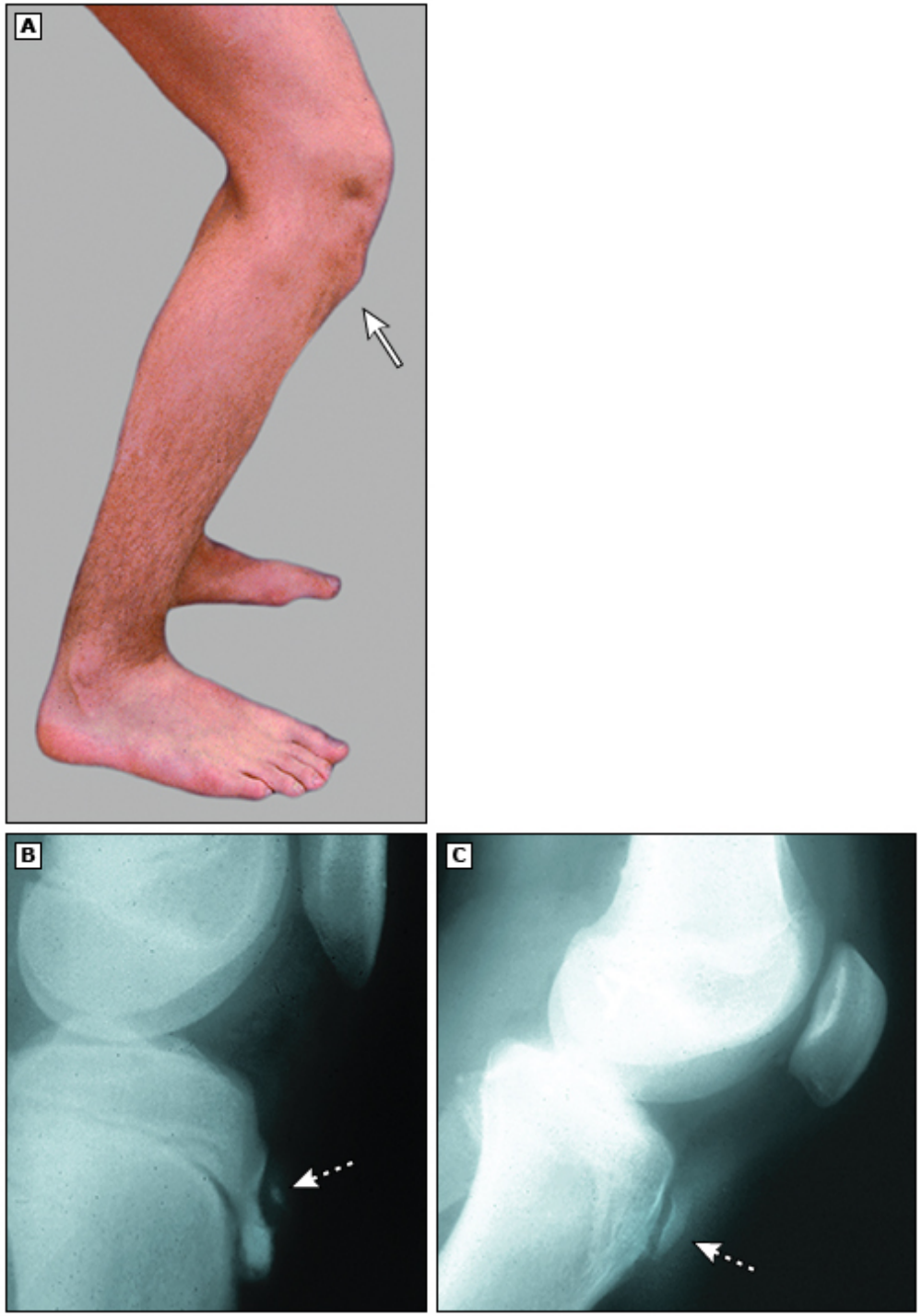
ML is a 12 yo Hispanic M with no significant PMH presenting with worsening limp for the past 6 months. He has also noted stable L knee pain during this time. The knee pain is worsened by activity, although he was able to play soccer with his friends yesterday. He cannot recall a specific event that started the pain. No known trauma. He has otherwise been in his usual state of health with no recent illnesses.

OSGOOD-SCHLATTER DISEASE

- Apophysitis of the tibial tuberosity
- Overuse injury
- Pain worsened by activity (running, jumping) or kneeling. Improved with rest
- Swelling and focal tenderness at tibial tuberosity
- Clinical diagnosis



Anterior (front) view of knee


A
B
C

OSGOOD-SCHLATTER DISEASE

- Age 8-15 yo
- Occurs in up to 20% of active athletes
- Bilateral in 20-30%

OSGOOD-SCHLATTER DISEASE

- Self-limited
- Conservative management
  - Rest/activity modification
  - Ice
  - NSAIDs
  - Maybe some PT
  - Lidocaine injection or Surgery for refractory cases

- Symptoms may wax and wane x 12-18 months before complete resolution

CASE #4

FM is a 15 yo Caucasian F with a history of Asthma who presents with an intermittent limp for the past 2-3 months. She plays lacrosse for her high school and tells you she began having R knee pain after running into one of the opposing players during a game a few months ago. Since that time she has had a deep, aching pain on the upper part of her R knee. This is associated with minor swelling. The pain is worsened slightly by activity but she notices it even while sitting and watching TV. Occasionally the pain has awakened her from sleep. She notes that she sometimes feels "warm" but has not checked her temperature at home. She continues to play lacrosse but now becomes more quickly fatigued.

CASE #4

Vitals:

Afebrile, VSS

Physical exam:

Gen: Mildly uncomfortable

CV, Pulm, Abd, Neuro, Back exams all normal

MSK: L hip and knee exams normal. R hip with full ROM, no pain with log roll. R knee without effusion or joint line tenderness. No laxity. Full ROM. Focal area of swelling and tenderness approx 5 cm superior to superior pole of patella. No overlying erythema.

WORKUP?

LABS

WBC 5.6

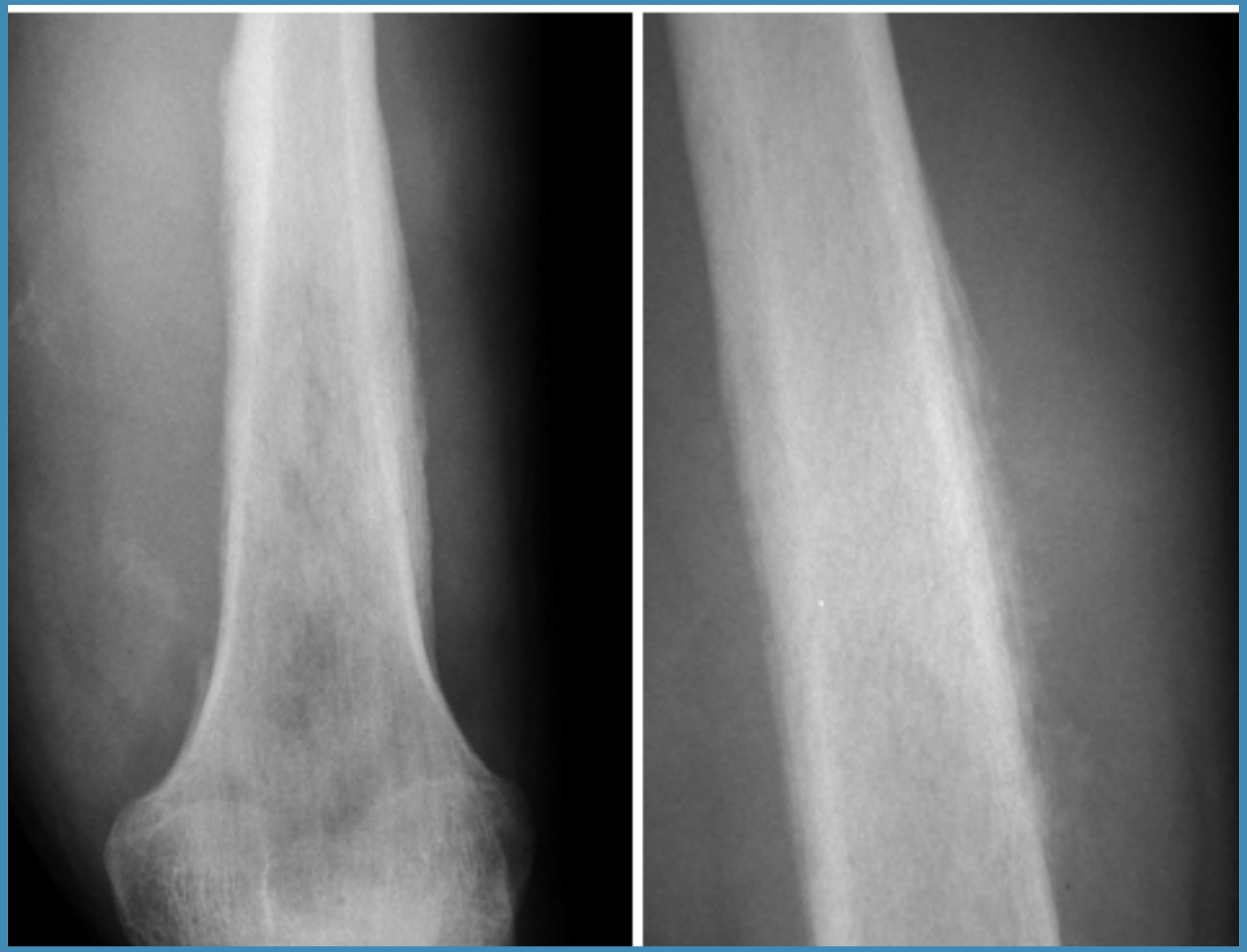
Hgb 10.9

ESR, CRP wnl

LDH 412 (Ref: 110-283 U/L)
Alk Phos 503 (Ref: 82-331 U/L)

IMAGING


Dx



AP

Lateral

WHAT IS THE MOST LIKELY CAUSE OF THIS PATIENT'S LIMP?

EWING SARCOMA

FM is a 15 yo Caucasian F with a history of Asthma who presents with an intermittent limp for the past 2-3 months. She plays lacrosse for her high school and tells you she began having R knee pain after running into one of the opposing players during a game a few months ago. Since that time she has had a deep, aching pain on the upper part of her R knee. This is associated with minor swelling. The pain is worsened slightly by activity but she even notices it while sitting and watching TV. Occasionally the pain has awakened her from sleep. She notes that she sometimes feels "warm" but has not checked her temperature at home. She continues to play lacrosse but now becomes more quickly fatigued.

EWING SARCOMA

- *EWSR1-FLI1* caused by t(11,22)
  - Present in 85% of cases
- 2-3 per 1,000,000
- Accounts for:
  - 2.6% of pediatric cancers
- Can occur in any bone
  - Pelvis, long bones, chest wall, spine

EWING SARCOMA

- Localized bone pain at rest or at night → malignancy
- Fever, fatigue, weight loss, night sweats
- LDH, Alk Phos as prognostic indicators

- MRI +/- PET, biopsy, refer to Oncology

CASE #5

JV is a 14 yo Hispanic M with a history of Obesity and Hypothyroidism presenting with a persistent limp. The limp has been present for about 1 month and is associated with a dull, aching pain in his R groin radiating to his R anterior thigh. The patient denies any traumatic event. Activities such as walking and jumping make the pain worse. He denies any recent illness and otherwise feels well.

CASE #5

Vitals:

AVSS

BMI 32

Physical Exam:

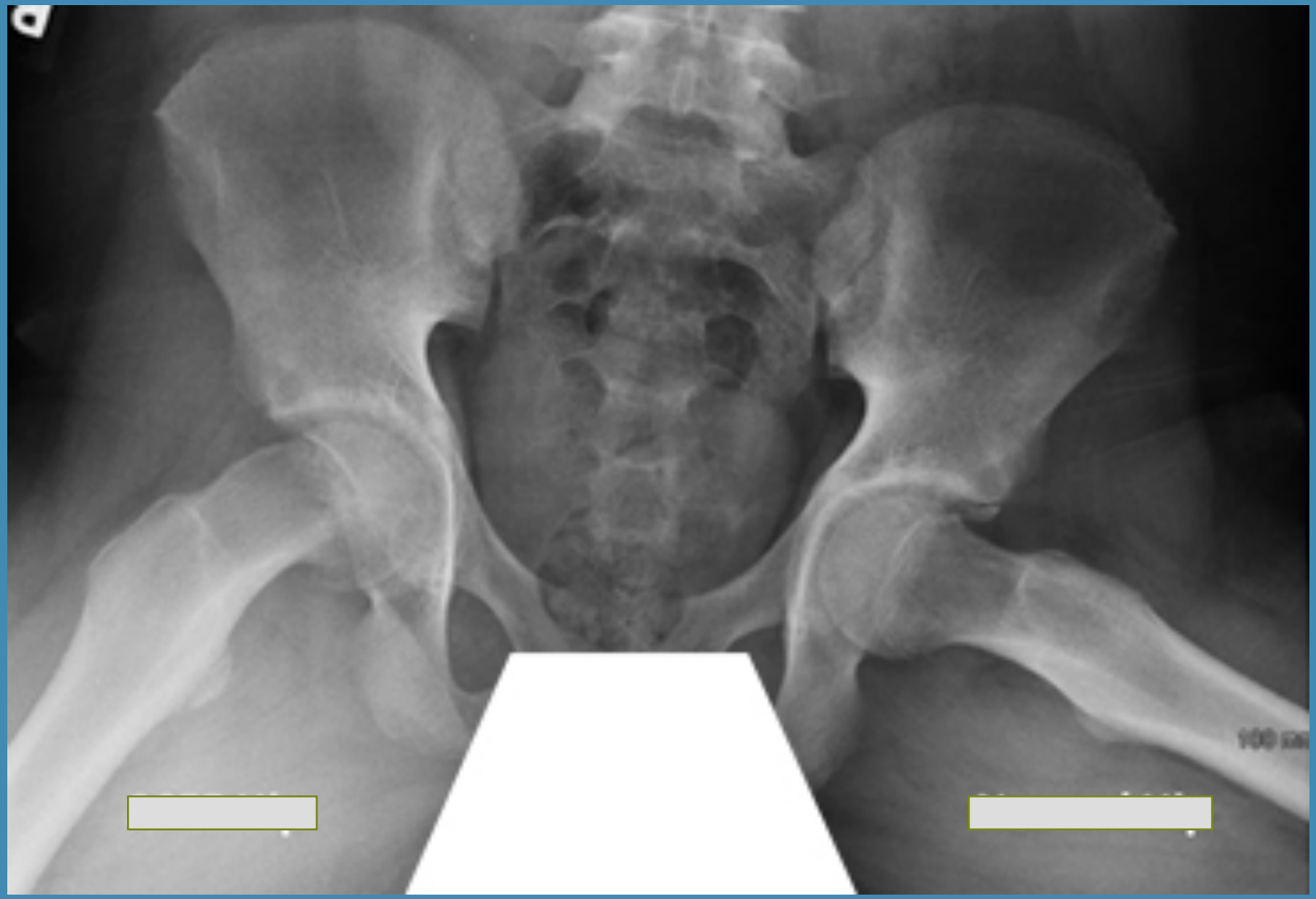
Gen: Comfortable lying in bed. NAD

CV, Pulm, Abd, Back exams all normal.

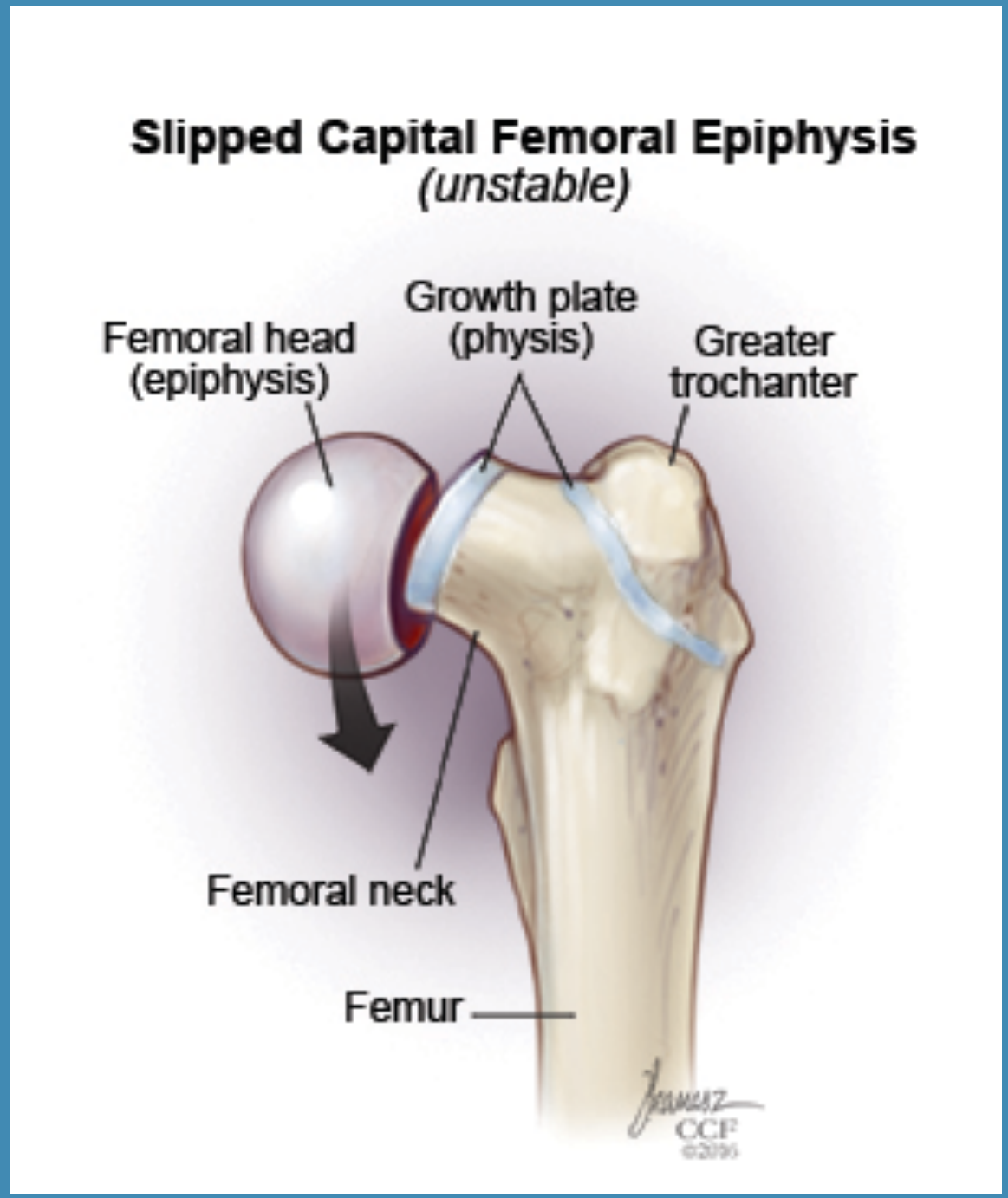
MSK: Log roll on R weakly positive. Decreased ROM on internal rotation and hip flexion. Weakness on R hip abduction. + Drehmann Sign. R knee exam normal.

Gait: Antalgic gait with shortened stance phase on the R. Able to bear weight. Excessive tilting of the torso to the R when planted with R foot

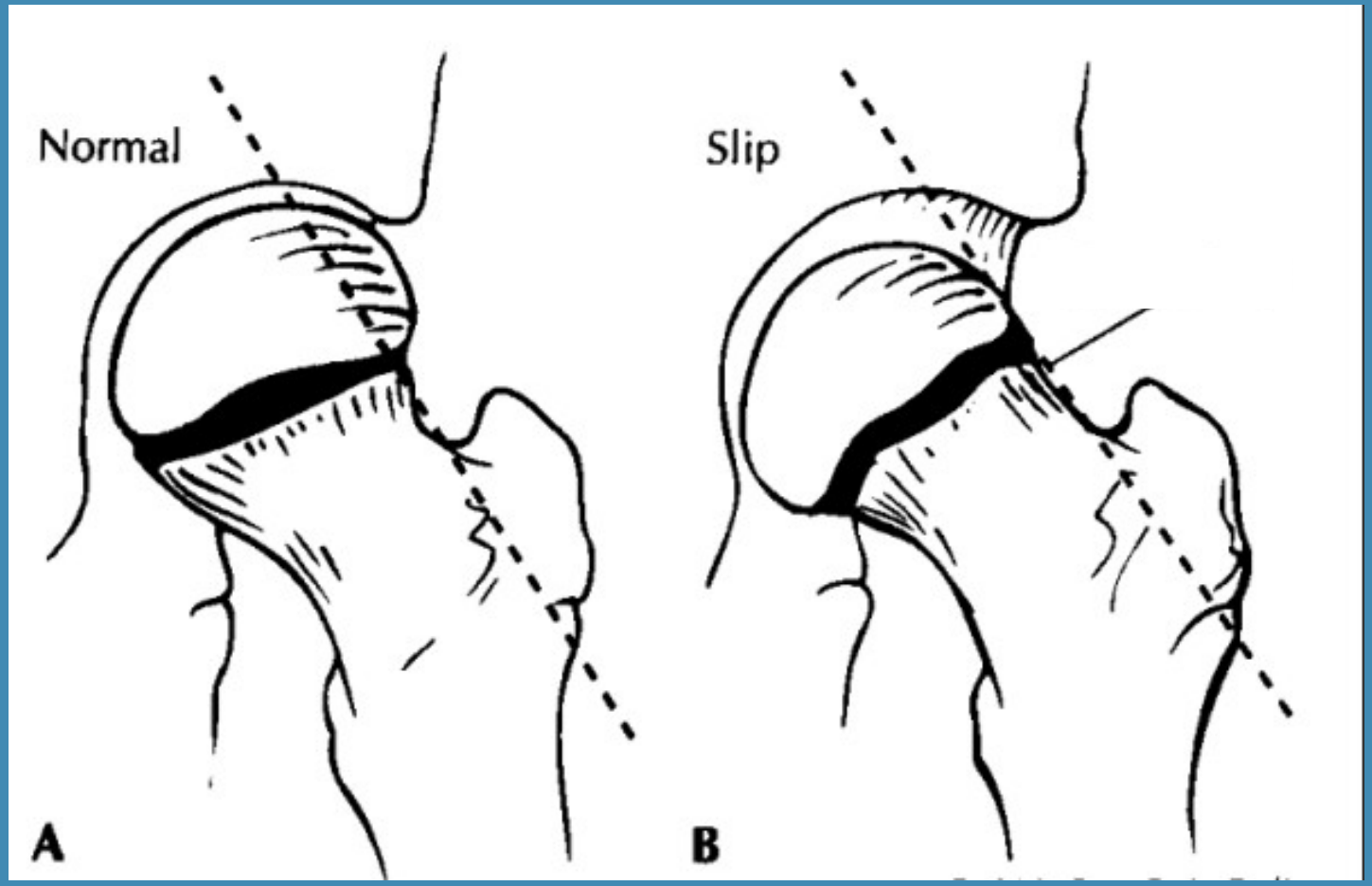
WORKUP?

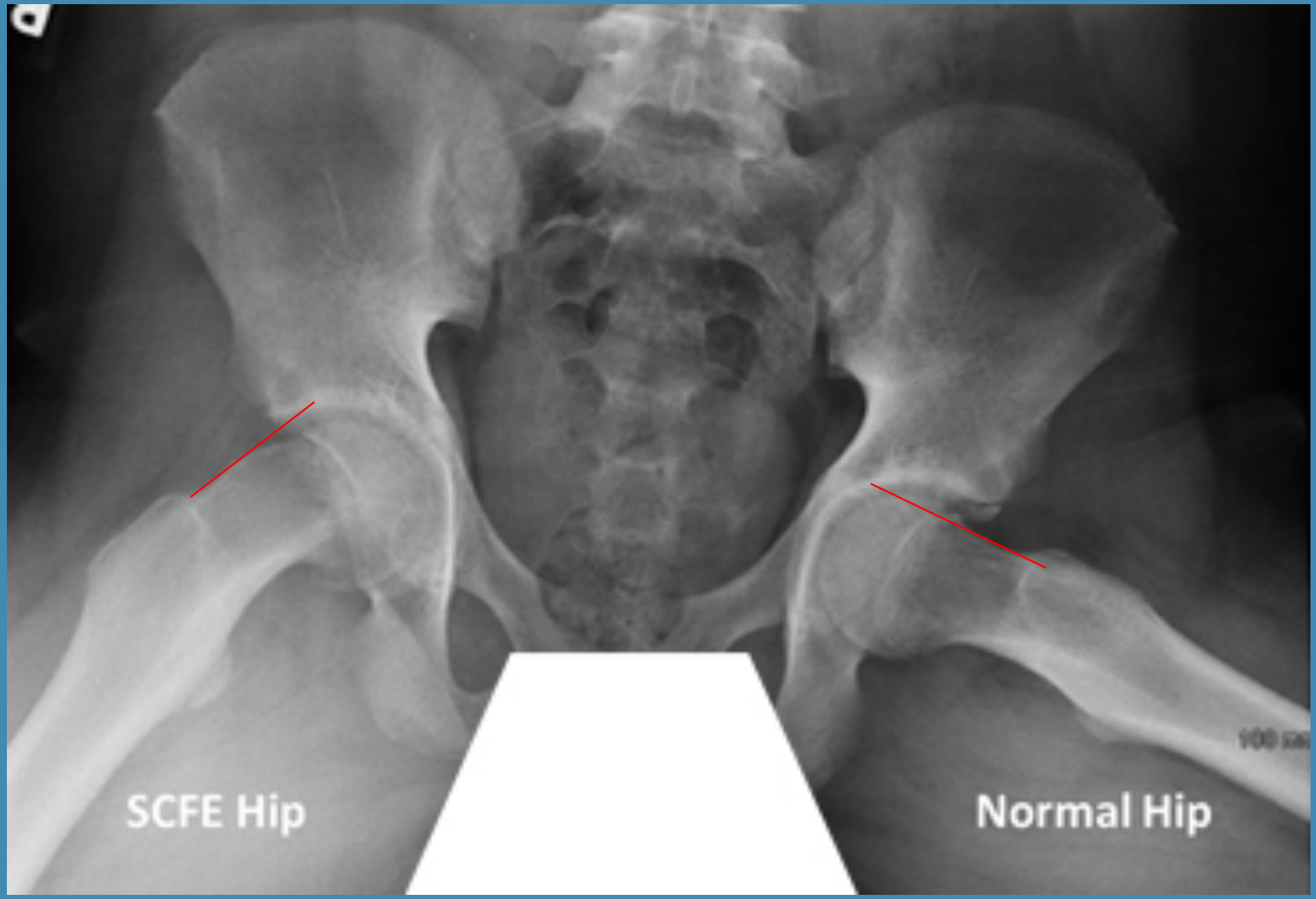


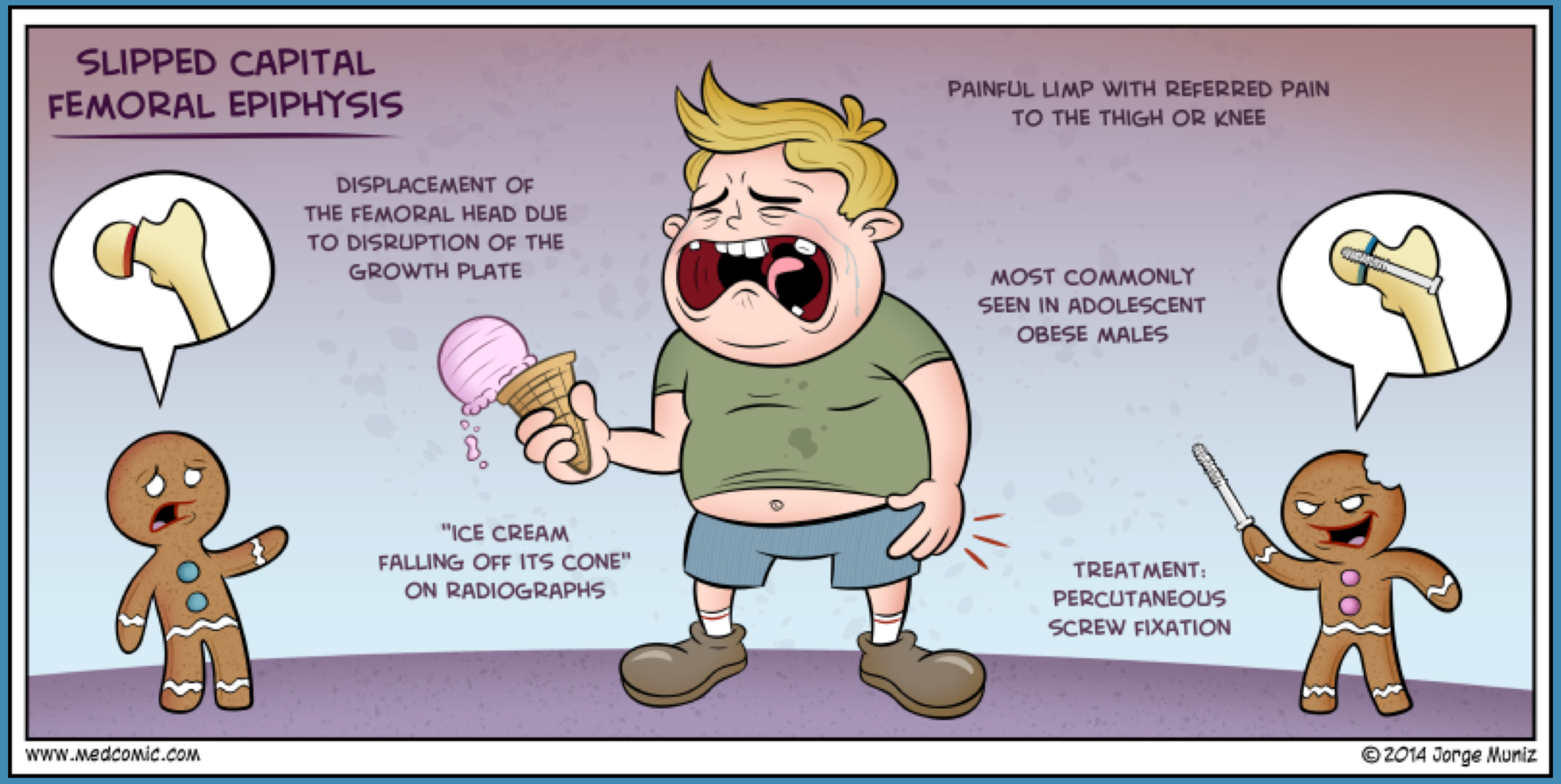
WHAT IS THE MOST LIKELY CAUSE OF THIS PATIENT'S LIMP?

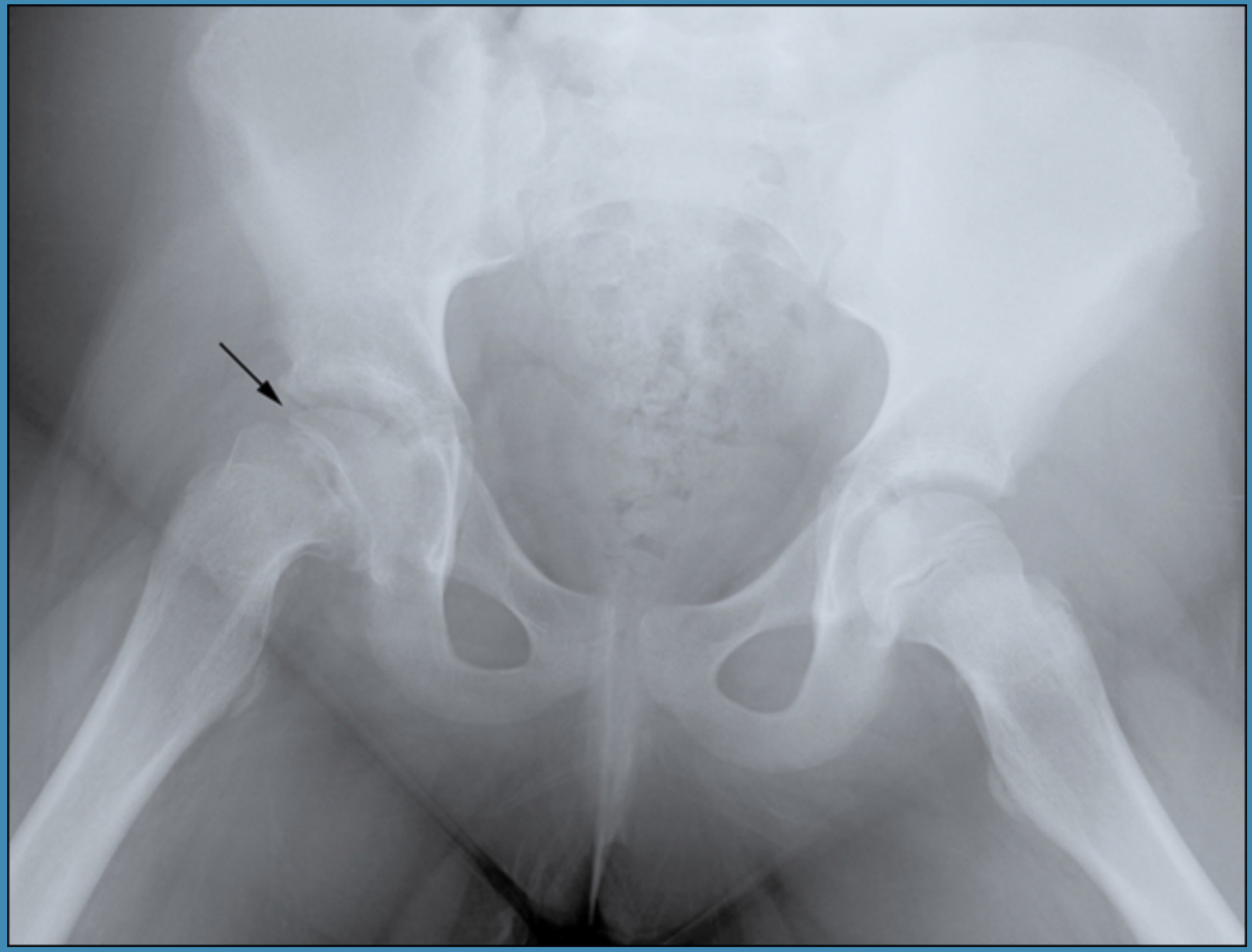

Slipped Capital Femoral Epiphysis
(unstable)
Femoral head
(epiphysis)
Growth plate
(physis)
Greater
trochanter
Femoral neck
Femur
CCF

KLEIN'S LINE




SCFE Hip
Normal Hip


SLIPPED CAPITAL FEMORAL EPIPHYSIS
DISPLACEMENT OF THE FEMORAL HEAD DUE TO DISRUPTION OF THE GROWTH PLATE
"ICE CREAM FALLING OFF ITS CONE" ON RADIOGRAPHS
PAINFUL LIMP WITH REFERRED PAIN TO THE THIGH OR KNEE
MOST COMMONLY SEEN IN ADOLESCENT OBESE MALES
TREATMENT: PERCUTANEOUS SCREW FIXATION
www.medcomic.com
© 2014 Jorge Muniz



SCFE

- Age 8-16 yo
- M > F (2:1.4)
- AA, Hispanic, Pacific Islander
- Pain worse with flexion and internal rotation
- Risk factors:
  - Obesity
  - Growth spurt (adolescence)
  - Endocrine disorders affecting bone metabolism (ie: Hypothyroidism, GH deficiency)

SCFE

JV is a 14 yo Hispanic M with a history of Obesity and Hypothyroidism presenting with a persistent limp. The limp has been present for about 1 month and is associated with a dull, aching pain in his R groin radiating to his R anterior thigh. The patient denies any traumatic event. Activities such as walking and jumping make the pain worse. He denies any recent illness and otherwise feels well.

SCFE

- Involuntary external rotation upon flexion of hip (Drehmann Sign)
- Get X-rays → Klein's Line, "Ice cream falling off cone"
  - Bilateral AP and Frog Leg views

- Urgent Ortho eval
  - Screw fixation

- Complications:
  - Avascular necrosis
  - Osteoarthritis

CASE #6

SM is a 7 yo Caucasian F with no significant PMH presenting with recent onset of limp. Her grandmother notes that she was in her usual state of health until about 4-5 days ago when she had a fever to 102.2F at home associated with dry cough, runny nose, headache, decreased appetite, and malaise. Yesterday she suddenly began limping and is now very hesitant to walk or climb stairs. She has been lying down most of the day and notes worsening aching in her back and arms. Denies any recent trauma.

CASE #6

Vitals:

T 100.1F

HR 110

BP 95/62

RR 20

SpO2 97% on RA

Heart Rate (beats/min)			Respiratory Rate (breaths/min)	
Age	**Awake**	**Asleep**	**Age**	**Normal**
Neonate (<28 d)	100-205	90-160	Infant (<1 y)	30-53
Infant (1-12 mos)	100-190			
Toddler (1-2 y)	98-140	80-120	Toddler (1-2 y)	22-37
Preschool (3-5 y)	80-120	65-100	Preschool (3-5 y)	20-28
School-age (6-11 y)	75-118	58-90	School-age (6-11 y)	18-25
Adolescent (12-15 y)	60-100	50-90	Adolescent (12-15 y)	12-20
Reference: PALS Guidelines, 2015				

Blood Pressure (mmHg)				
Age		**Systolic**	**Diastolic**	**Systolic Hypotension**
Birth (12 h)	<1 kg	39-59	16-36	<40-50
	3 kg	60-76	31-45	<50
Neonate (96 h)		67-84	35-53	<60
Infant (1-12 mos)		72-104	37-56	<70
Toddler (1-2 y)		86-106	42-63	<70 + (age in years × 2)
Preschool (3-5 y)		89-112	46-72	
School-age (6-9 y)		97-115	57-76	
Preadolescent (10-11 y)		102-120	61-80	<90
Adolescent (12-15 y)		110-131	64-83	

CASE #6

Physical Exam:

Gen: Mildly ill-appearing but NAD

HEENT: TM wnl bilaterally. PERRLA. + clear rhinorrhea. Mild pharyngeal erythema without exudate. No tonsillar swelling or exudate.

CV: RRR. Pulses 2+ throughout

Pulm: CTAB

Abd: Soft, non-tender

Skin: Warm and moist. No rashes

CASE #6

Physical Exam (continued):

MSK: Hips with full ROM, no pain. Knees without effusion or joint line tenderness, full ROM. Bilateral calves swollen and exquisitely tender to palpation. No asymmetric swelling or erythema. + Homan's Sign bilaterally. Ankles without tenderness, full ROM.

Neuro: Strength 5/5 throughout except 4/5 on plantarflexion. DTRs 2+.

Gait: …

WORKUP?

WHAT IS THE MOST LIKELY CAUSE OF THIS PATIENT'S LIMP?

BENIGN ACUTE CHILDHOOD MYOSITIS

SM is a 7 yo Caucasian F with no significant PMH presenting with recent onset of limp. Her grandmother notes that she was in her usual state of health until about 4-5 days ago when she had a fever to 102.2F at home associated with dry cough, runny nose, headache, decreased appetite, and malaise. Yesterday she suddenly began limping and is now very hesitant to walk or climb stairs. She has been lying down most of the day and notes worsening aching in her back and arms. Denies any recent trauma.

BENIGN ACUTE CHILDHOOD MYOSITIS

- Pathogenesis largely unknown
- Self-limited
- Usually presents as viral URI symptoms resolve
- Severe complications:
  - Rhabdo (3%)
  - Myoglobinuric renal failure

- Clinical recovery in 3-10 days

CASE #7

RW is a 12 yo Caucasian M with no significant PMH presenting with a chronic limp. 6 months ago he began to have a vague, achy pain in both knees exacerbated by activity. This pain has progressively worsened and his knees are now very stiff. Per his mother he has been walking with a noticeable limp. His knees will sometimes lock and "give out" on him. There is no swelling but his knees will often click when walking or running. There was no known traumatic event. He plays baseball and can now barely run around the bases. Denies systemic symptoms such as F/C, rash, unexpected weight change. No other joints are involved.

CASE #7

AVSS

Physical Exam:

Gen: Well-appearing

MSK: Hips full ROM without pain. Knees without swelling, erythema, or warmth. + tenderness at lateral aspects of medial femoral condyles with knees flexed. + clicking with knee flexion. Lachmans negative. No laxity on varus/valgus. Ankles without significant findings.

Neuro: Strength 5/5 throughout. DTRs 2+

Gait: Keeps legs as straight as possible while ambulating. Antalgic gait

WORKUP?

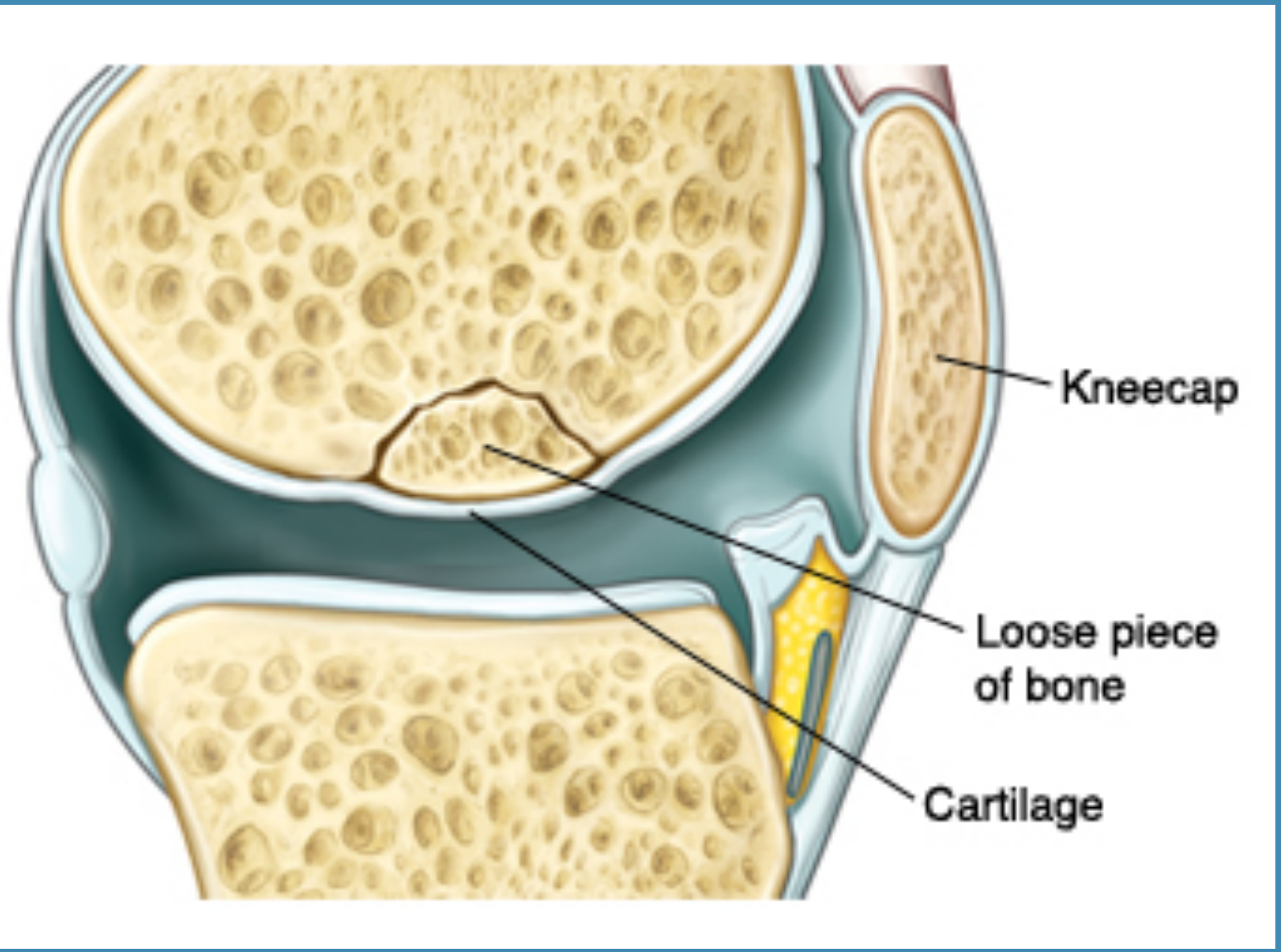

R


80 mm

WHAT IS THE MOST LIKELY CAUSE OF THIS PATIENT'S LIMP?

OSTEOCHONDRITIS DISSECANS

- Detachment of bone/cartilage fragment within a joint
- Knees >> ankles, elbows
- Risk factors:
  - Sports, physical activity
  - Obesity
  - Vit D deficiency


Kneecap
Loose piece of bone
Cartilage

UMass Memorial Medical Center

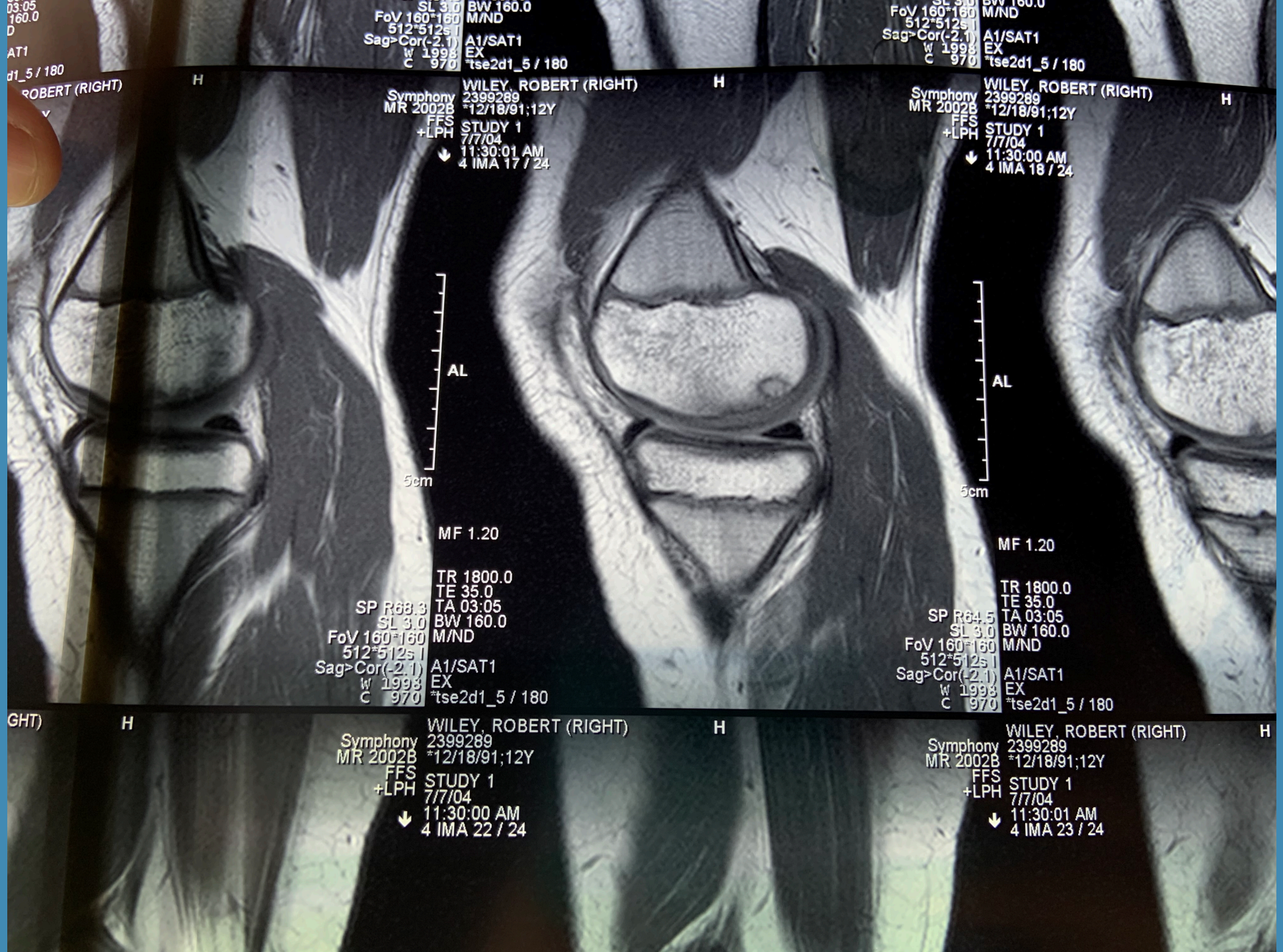
Patient:	WILEY, ROBERT				
D.O.B.	12/18/1991	Date of Visit:	10/15/2004	Location:	HA-SP
Dictated:	10/15/2004 7:04 P	Transcribed:	10/18/2004 5:50 A		

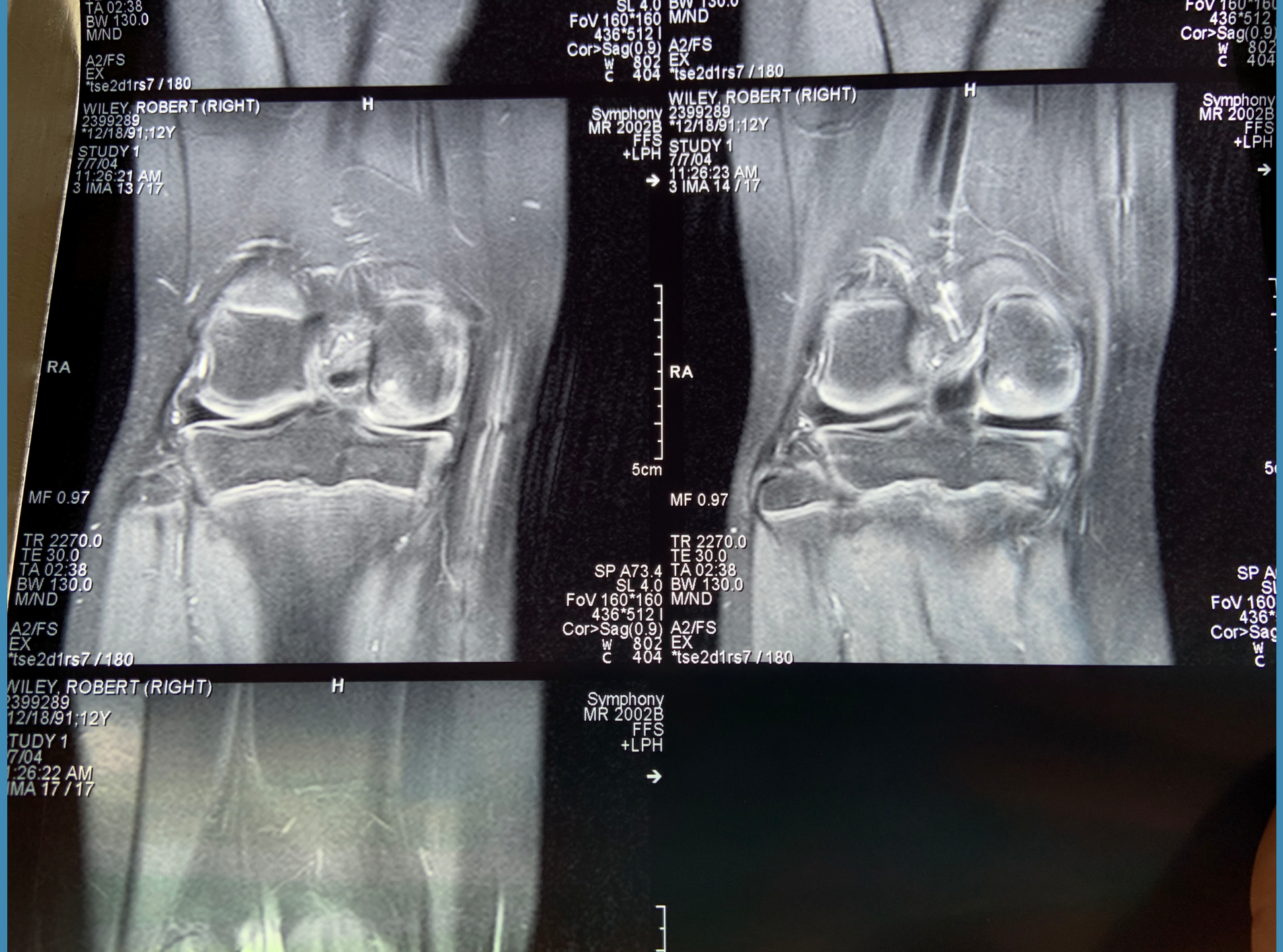
CLINIC NOTE

Bobby comes in today in follow up. He is a 12-year-old boy who has had trouble with both of his knees. We had diagnosed him with bilateral small OCDs about the posterior and lateral aspects of each of his medial femoral condyles. He presents for follow up. We have been treating him with anti-inflammatories, and activity restriction as necessary to avoid any pain and swelling with this knees. Overall, Bobby is feeling better today. He has been back to playing both football and baseball around the neighborhood with his friends without much pain in his knees. He has been taking anti-inflammatories only intermittently. Overall, he fells that he is much improved.

On exam today, Bobby is in no acute distress. Examination of his right knee shows full range of motion. There is no effusion today. He is ligamentously stable. Examination of his left knee similarly shows full range of motion. There is no effusion. He is ligamentously stable.

ASSESSMENT/PLAN: Bobby Wiley is a 12-year-old boy with most likely bilateral medial femoral condyle OCDs. He is slowly improving with our conservative treatment plan. Our plan at this point would be to allow him to continue with activity as tolerated. I have encouraged him to take it easy if he does develop pain and swelling. I will see him back in three to four months, or earlier if he has any problems. He came in today with his mom and his sister. All of their questions were answered today.


WILEY, ROBERT (RIGHT)
Symphony 2399289
MR 2002B *12/18/91;12Y
FFS STUDY 1
+LPH 7/7/04
11:30:01 AM
4 IMA 17 / 24
AL
5cm
MF 1.20
TR 1800.0
TE 35.0
SP R68.3 TA 03:05
SL 3.0 BW 160.0
FoV 160*160 M/ND
512*512s I
Sag>Cor(-2.1) A1/SAT1
W 1998 EX
C 970 *tse2d1_5 / 180
WILEY, ROBERT (RIGHT)
Symphony 2399289
MR 2002B *12/18/91;12Y
FFS STUDY 1
+LPH 7/7/04
11:30:00 AM
4 IMA 18 / 24
AL
5cm
MF 1.20
TR 1800.0
TE 35.0
SP R64.5 TA 03:05
SL 3.0 BW 160.0
FoV 160*160 M/ND
512*512s I
Sag>Cor(-2.1) A1/SAT1
W 1998 EX
C 970 *tse2d1_5 / 180
WILEY, ROBERT (RIGHT)
Symphony 2399289
MR 2002B *12/18/91;12Y
FFS STUDY 1
+LPH 7/7/04
11:30:00 AM
4 IMA 22 / 24
WILEY, ROBERT (RIGHT)
Symphony 2399289
MR 2002B *12/18/91;12Y
FFS STUDY 1
+LPH 7/7/04
11:30:01 AM
4 IMA 23 / 24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BW 130.0
M/ND
A2/FS
EX
*tse2d1rs7 / 180
WILEY, ROBERT (RIGHT)
2399289
*12/18/91;12Y
STUDY 1
7/7/04
11:26:21 AM
3 IMA 13 / 17
H
RA
MF 0.97
TR 2270.0
TE 30.0
TA 02:38
BW 130.0
M/ND
A2/FS
EX
*tse2d1rs7 / 180
SP A73.4
SL 4.0
FoV 160*160
436*512 I
Cor>Sag(0.9)
W 802
C 404
Symphony
MR 2002B
FFS
+LPH
11:26:23 AM
3 IMA 14 / 17
5cm
11:26:22 AM
IMA 17 / 17

OSTEOCHONDRITIS DISSECANS

- Xrays are often diagnostic
  - Get bilateral
  - Tunnel, sunrise/merchant views

- MRI can sometimes be used to clarify lesion characteristics

OSTEOCHONDRITIS DISSECANS

- For stable cases in skeletally immature children:
  - NSAIDs, ice
  - Rest, activity modification
  - PT
  - Slowly increase joint-loading

- Complications:
  - Premature OA

Causes of limp in children by location of abnormality

Lower extremity (bone)
Osteomyelitis
Fracture, including occult fracture (child abuse) and stress fracture
Traction apophysitis
Sinding-Larsen-Johansson disease (inferior patella)
Sever disease (calcaneus)
Osgood-Schlatter disease (tibial tuberosity)
Iselin disease (base of the 5th metatarsal)
Osteochondrosis
Freiberg disease (head of the 2nd metatarsal)
Köhler disease (navicular bone of the foot)
Slipped capital femoral epiphysis
Idiopathic avascular necrosis of the hip (Legg-Calvé-Perthes disease)
Benign and malignant tumors
Leukemia
Metastatic neuroblastoma
Osteogenic sarcoma
Ewing sarcoma
Osteoid osteoma
Limb length discrepancy
Pathologic varus (bow legs)
Pathologic valgus (knock knees)
Tarsal coalition
Torsional deformities
Vasoocclusive crisis (sickle cell disease)
Lower extremity (joint)
Transient synovitis of the hip
Bacterial (septic) arthritis
Lyme arthritis (endemic regions)
Osteochondritis dissecans
Developmental dysplasia of the hip
Oligoarticular juvenile idiopathic arthritis (JIA) and other rheumatic diseases (eg, systemic lupus erythematosus, systemic JIA)
Immunoglobulin A vasculitis (Henoch-Schönlein purpura)
Serum sickness and serum sickness-like reactions
Reactive arthritis
Acute rheumatic fever
Joint hypermobility syndrome
Hemarthrosis (causes include trauma, hemophilia, and, rarely, pigmented villonodular synovitis)

Lower extremity (soft tissue)
Contusion (superficial or deep [muscle])
Muscle strain
Ligament sprain
Tendinopathy
Compartment syndrome
Benign acute myositis
Foot injury (foreign body, blisters, puncture wound, abrasions, or lacerations)
Hand, foot, and mouth disease (painful vesicles on the plantar foot)
Intramuscular vaccination
Insect bite or sting (eg, fire ant, bee, wasp, or yellow jacket)
Superficial infection (eg, cellulitis, cutaneous abscess, or perirectal abscess)
Pyomyositis
Spinal column
Spondylolysis and spondylolisthesis
Closed spinal dysraphism with tethered cord
Herniated vertebral disc
Spinal epidural abscess
Discitis
Skeletal tuberculosis (Pott disease)
Neuromuscular
Cerebral palsy
Peripheral neuropathy
Muscular dystrophy
Myasthenia gravis
Tick paralysis
Complex regional pain syndrome (reflex sympathetic dystrophy)
Spinal cord tumor
Intra-abdominal
Appendicitis
Pelvic inflammatory disease
Pelvic abscess
Psoas abscess
Iliac adenitis
Other
Testicular torsion
Somatic symptom disorder (conversion disorder)

West J Emerg Med. 2011 Nov;12(4):515-9. doi: 10.5811/westjem.2011.3.2126.

Torsion of undescended testis in a 14-month-old child refusing to bear weight

Ryan M Knight [1], Peter J Cuenca

Affiliations + expand

PMID: 22224149 PMCID: PMC3236161 DOI: 10.5811/westjem.2011.3.2126

Free PMC article

Abstract

In this report, we discuss a case of a 14-month-old male presenting in the emergency department with refusal to bear weight on his left leg. Plain radiographic studies revealed no evidence of effusion, fracture, or dislocation. Laboratory studies were significant for an elevated white blood cell count, erythrocyte sedimentation rate, and C-reactive protein. Further studies included unremarkable ultrasound of the left hip and normal magnetic resonance imaging (MRI) of both hips. An incidental finding on MRI was a left inguinal mass concerning an incarcerated hernia. Ultrasound of this mass demonstrated a left undescended testis within the inguinal canal and possible incarcerated paratesticular inguinal hernia. The final pathologic diagnosis of a torsed gangrenous left testicle within the inguinal canal was confirmed during surgery.

Diagnosis of a Child with an Antalgic Gait

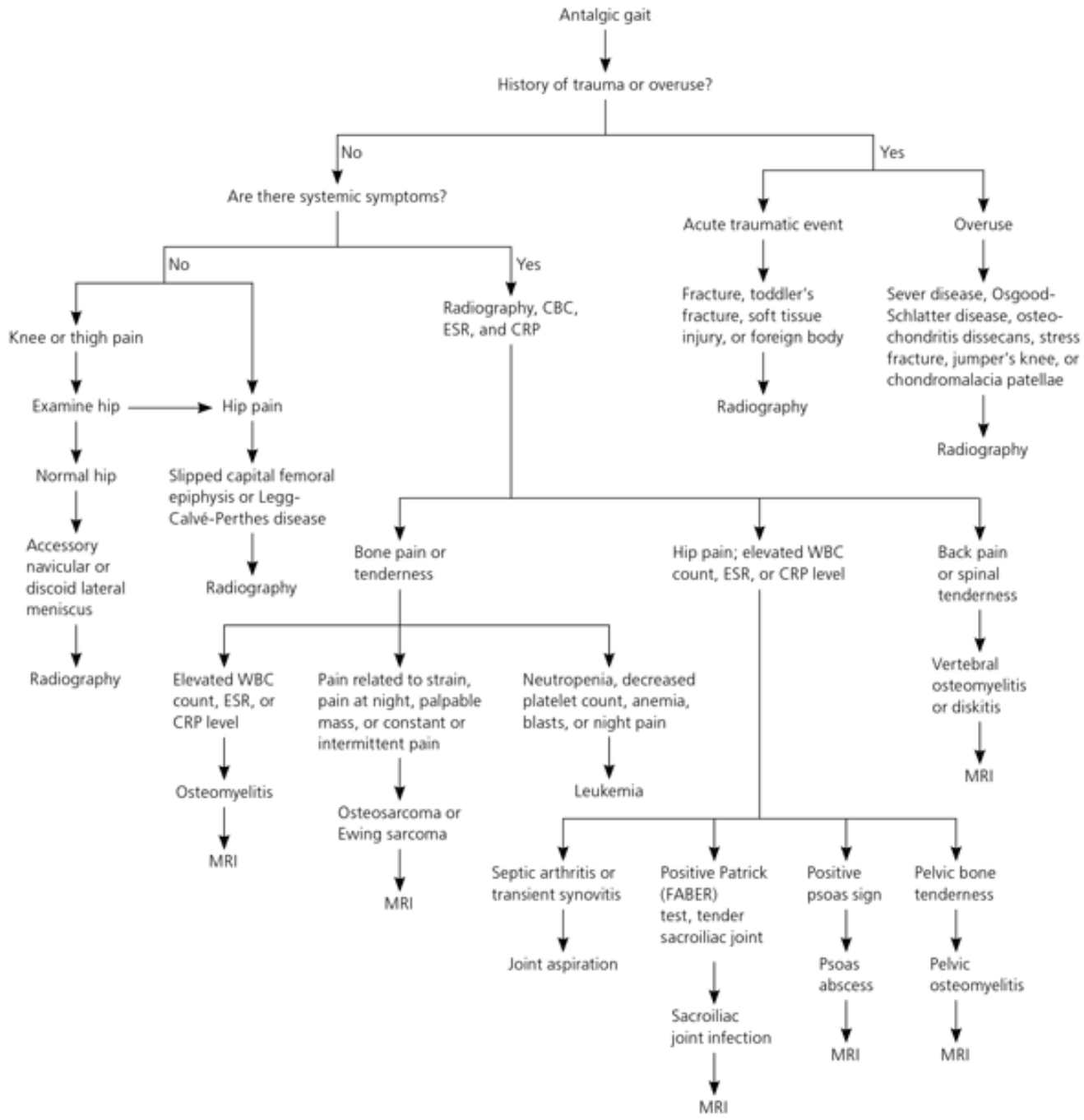

Figure 1.
Diagnostic approach to a limping child with an antalgic gait. (CBC = complete blood count; CRP = C-reactive protein; ESR = erythrocyte sedimentation rate; MRI = magnetic resonance imaging; WBC = white blood cell.)
Adapted with permission from Sawyer JR, Kapoor M. The limping child: a systematic approach to diagnosis. Am Fam Physician. *2009;79(3):217.*

Diagnosis of a Child with a Non-antalgic Gait

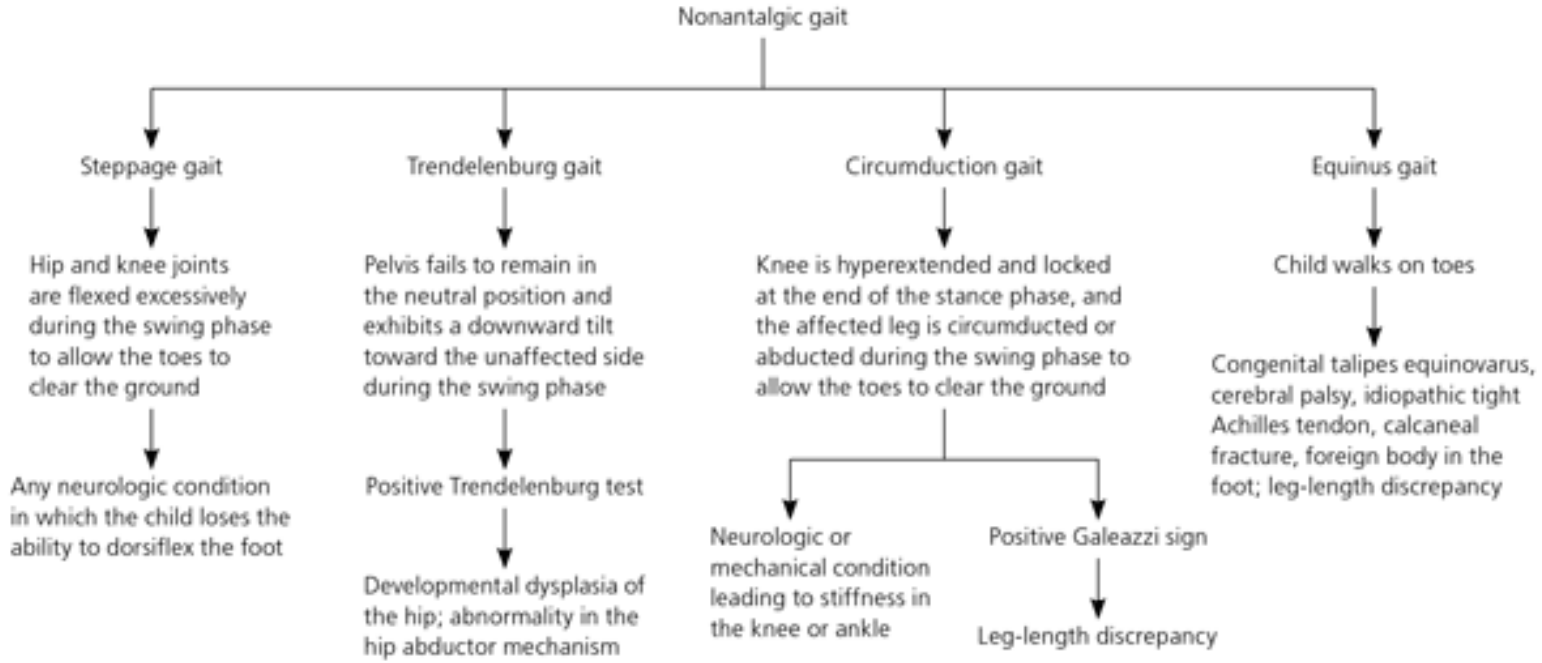

Figure 2.
Diagnostic approach to a limping child with a non-antalgic gait.
Adapted with permission from Sawyer JR, Kapoor M. The limping child: a systematic approach to diagnosis. Am Fam Physician. *2009;79(3):216*.

SUMMARY

- Limp is any deviation from an age-appropriate gait
- Atraumatic limp in a child is common
- First rule out life- or limb-threatening conditions
- Keep initial differential very broad to include things other than the lower extremity
- Type of limp can point towards certain diagnoses
- Use epidemiology to your advantage
- Tailor labs/imaging to suspected pathology
- When in doubt get CBC, ESR, CRP, and Xrays

QUESTIONS?

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